Claims

1. A device for recording the motion of a wafer, including fine perturbations and vibrations in the motion of said wafer, during its progress through and between semiconductor process and inspection machines in the course of the actual manufacturing process or in test cycles of said machines, comprising a test wafer to which a miniature electronic recording system is attached, said system being provided with memory means for storing information relative to the physical history of the wafer, and means for connecting to downloading connections through which the stored data can be transmitted to an external device.

2. A device according to claim 1, wherein the test wafer is selected from the group comprising:
   - wafers the surface areas and shapes, thicknesses, and weights of which essentially equal those of standard size production wafers; and
   - wafers the surface areas and shapes of which essentially equal those of standard size production wafers but the thicknesses and/or weights of which differ from those of standard size production wafers.

3. A device according to claim 2, wherein the test wafer is made from a material selected from the group comprising:

- silicon;
- aluminum;
- glass;
- gallium arsenide;
- ceramic material; and
- plastic.

4. A device according to claim 1, wherein the miniature electronic recording system is attached to the test wafer by means selected from the group comprised of:

– gluing;
– screwing; and
– bolting;

5. A device according to claim 1, wherein the components of the miniature electronic recording system are mounted on one or more circuit boards.

6. A device according to claim 1, wherein the miniature electronic recording system is covered by an epoxy block molded on the wafer.

7. A device according to claim 1, wherein a thin hermetic external cover is mounted over the miniature electronic recording system and is attached to the wafer.

8. A device according to claim 7, wherein the hermetic thin casing has a thickness such that the maximum height of the electronics and cover is preferably no more than 2mm.

9. A device according to claim 7, wherein the hermetic thin casing is made of a material chosen from the group comprised of:

- aluminum;
- stainless steel;
- composite materials;
- polyurethane;
- silicon;
- ceramic materials; and
- plastic.

10. A device according to claim 1, wherein the components of the miniature electronic recording system are selected from the group comprised of:

- accelerometers;
- analog-to-digital converters;

- microprocessors;
- batteries;
- memory units;
- temperature sensors; and
- additional standard electronic components.

11. A device according to claim 10, wherein the accelerometers are selected from the group comprised of:
    - dual-axis accelerometers;
    - 3-axis accelerometers; and
    - piezoelectric accelerometers.

12. A device according to claim 10, wherein the analog-to-digital converter includes an analog multiplexer which enables the digitizing of a multitude of analog signals.

13. A device according to claim 10, wherein the microprocessor includes a real-time clock and internal program memory.

14. A device according to claim 10, wherein the battery is a rechargeable battery.

15. A device according to claim 14, wherein the rechargeable

battery is a lithium polymer battery.

16. A device according to claim 10, wherein the memory unit is composed of RAM memory and/or Flash memory.

17. A device according to claim 1, wherein additional sensors are attached to the test wafer, said sensors being suitable to measure parameters selected from the group comprised of:

- temperature;
- light;
- pressure;
- air-flow;
- gas flow;
- humidity;
- clearance;
- electric field; and
- magnetic field.

18. A device according to claim 1, wherein a miniature camera is attached to the test wafer.

19. A device according to claim 1, wherein the miniature electronic recording system detects the motion of the test

wafer to which it is attached and uses the presence or absence of said motion to switch off or wake up said electronics in order to conserve power.

20. A system for recording the motion of a wafer, including fine perturbations and vibrations in the motion of said wafer, during its progress through and between semiconductor process and inspection machines in the course of the actual manufacturing process or in test cycles of said machines, said system comprising:

- a test wafer;
- a reader station; and
- a computer.

21. A system according to claim 20, wherein the test wafer is substantially as claimed in any one of claims 1 to 19.

22. A system according to claim 20 wherein the reader station is essentially comprised of:

- an AC power supply;
- interface circuits between the test wafer and the computer; and, if necessary
- a battery charger.

23. A system according to claim 22, wherein the interface circuits of the reader station are electronic interface circuits.

24. A system according to claim 22, wherein the interface circuits of the reader station are non-contact interface circuits.

25. A system according to claim 24, wherein the non-contact interface circuits of the reader station are optical interface circuits or radio frequency interface circuits.

26. A method for using a record of the motion of a wafer, including fine perturbations and vibrations in the motion of said wafer, during its progress through and between semiconductor process and inspection machines in the course of the actual manufacturing process or in test cycles of said machines, to detect, locate, and identify any mechanical malfunction of the processing machine which has caused, or could cause, defects in the manufactured wafer, comprising the following steps:

- placing said test wafer on the reader station;
- initializing said test wafer;

- transferring said test wafer to said processing machine;
- recording data relative to the physical history of said wafer in the internal Flash or other type memory of the electronics circuit on said test wafer;
- returning said test wafer to said reader station;
- downloading said recorded data into the computer;
- erasing, if desired, said internal Flash memory of said test wafer;
- processing the signals from the accelerometer on said test wafer; and
- comparing said recorded data to known data and interpreting the results.

27. A method according to claim 26, wherein initializing the test wafer includes some or all of the following steps:

- recharging the battery;
- downloading different versions of recording programs and/or other parameters from the computer into the RAM memory of the test wafer; and
- - initializing the real-time clock.

28. A method according to claim 26, wherein the signals are processed using one of the strategies selected from the group comprising:

- on-wafer signal processing followed by low sampling-rate signal digitizing; and
- high-rate signal sampling followed by computer-based signal processing.

29. A method according to claim 26, wherein the known data to which the recorded data is compared is selected from the group comprising:
- the precise known time-schedule of events inside the processing machine; and
- "known-good" readings or "fingerprints" of signals previously recorded on the same or on similar processing machine.

30. A method according to claim 26, wherein comparing the recorded data to known data additionally comprises the use of special software for signal recognition to automatically detect and interpret "known" problems.